EASTERN STATES FARMERS EXCHANGE
FEED MILL ELEVATOR
(Eastern States Elevator)
1132 Military Road
Tonawanda
Erie County
New York

HAER No. NY-260

WRITTEN HISTORICAL AND DESCRIPTIVE DATA
PHOTOGRAPHS

Historic American Engineering Record
National Park Service
U.S. Department of The Interior
P.O. Box 37127
Washington, D.C. 20013-7127

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HISTORIC AMERICAN ENGINEERING RECORD

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FEED MILL ELEVATOR
(Eastern States Elevator)
HAER No. NY-260

Location: 1132 Military Road, Tonawanda, Erie County, NY

Date: Mainhouse: construction began March, 1934; completed October, 1934
Annex: plans dated autumn 1945; construction, 1946

Designer: Mainhouse & Annex: A. E. Baxter Engineering Company

Builder: Mainhouse: James MacDonald Engineering Company; Annex: James Stewart Company

Status: Derelict

Significance: The grain elevators of Buffalo comprise the most outstanding collection of extant grain elevators in the United States, and collectively represent the variety of construction materials, building forms, and technological innovations that revolutionized the handling of grain in this country.

Project Information: The documentation of Buffalo's grain elevators was prepared by the Historic American Engineering Record (HAER), National Park Service, in 1990 and 1991. The project was co-sponsored by the Industrial Heritage Committee, Inc., of Buffalo, Lorraine Pierro, President, with the cooperation of The Pillsbury Company, Mark Norton, Plant Manager, Walter Dutka, Senior Mechanical Engineer, and with the valuable assistance of Henry Baxter, Henry Wollenberg, and Jerry Malloy. The HAER documentation was prepared under the supervision of Robert Kapsch, Chief, HABS/HAER, and Eric DeLony, Chief and Principal Architect, HAER. The project was managed by Robbyn Jackson, Architect, HAER, and the team consisted of: Craig Strong, Supervising Architect; Todd Croteau, Christopher Payne, Patricia Reese, architects; Thomas Leary, Supervising Historian; John Healey, and Elizabeth Sholes, historians. Large-format photography was done by Jet Lowe, HAER photographer.

Historians: Thomas E. Leary, John R. Healey, Elizabeth C. Sholes, 1990-1991

This is one in a series of HAER reports for the Buffalo Grain Elevator Project. HAER No. NY-239, "Buffalo Grain Elevators," contains an overview history of the elevators. The following elevators have separate reports:

NY-240 Great Northern Elevator
NY-241 Standard Elevator
NY-242 Wollenberg Grain & Seed Elevator
NY-243 Concrete-Central Elevator
NY-244 Washburn Crosby Elevator
NY-245 Connecting Terminal Elevator
NY-246 Spencer Kellogg Elevator
NY-247 Cooperative Grange League Federation
NY-248 Electric Elevator
NY-249 American Elevator
NY-250 Perot Elevator
NY-251 Lake & Rail Elevator
NY-252 Marine "A" Elevator
NY-253 Superior Elevator
NY-254 Saskatchewan Cooperative Elevator
NY-256 Urban Elevator
NY-257 H-O Oats Elevator
NY-258 Kreiner Malting Elevator
NY-259 Meyer Malting Elevator
NY-260 Eastern States Elevator

In addition, the Appendix of HAER No. NY-239 contains brief notations on the following elevators:

Buffalo Cereal Elevator
Cloverleaf Milling Co. Elevator
Dakota Elevator
Dellwood Elevator
Great Eastern Elevator
Iron Elevator
John Kam Malting Elevator
Monarch Elevator
Pratt Foods Elevator
Ralston Purina Elevator
Riverside Malting Elevator

This inland complex has its origins in the Clover Leaf Milling Company's plant established during the second decade of the twentieth century. At that time, the company constructed a substantial ten-story reinforced concrete mill. This mill and subsequent addition comprised the extensive range of concrete warehouses and railroad loading sheds to the east and north that became the basis for Eastern States Farmers Exchange animal feed milling operations. The original storage was provided in three low freestanding steel tanks rising directly from grade level. In 1934 the new owners commissioned a concrete elevator designed by A. E. Baxter Engineering and built by the James McDonald Company. The structure was slip formed from the basement slab using the McDonald Patent jacking system. Construction began in March of 1934, and the elevator was complete and operational by October of the same year.[1]

The elevator's capacity of 1,013,000 bushels is stored in cylindrical bins arranged in three parallel rows of ten bins that enclose eighteen interspace bins. The bins are of the basement wall type, with the walls rising directly from the foundation slab and the bin bottom hopper raised on radially arranged pillars within the bins. The bins are 21' in inner diameter, rise 110'-9" from the foundation slab, and measure 97'-6" deep from the top of the ring girder. The six bins closest to the workhouse are slightly shallower to accommodate the rise of the basement conveyors to the elevator boots. The interspace bins are shallower than the main bins so that a high spouting angle can be maintained to the conveyors beneath them.

The bins are arranged longitudinally with tangential contacts, and transversely by straight link wall contacts. The tangential wall thickening extends 4'-9" either side of the center line, and the link walls are 2'-6" long. The elevator is the first bin wall basement elevator in Buffalo to use link wall contacts to increase the volume of storage in the interspace bins. The conincidence of basement conveyors with the placing of conventional link wall contacts makes such longitudinally spread bins structurally complicated. The bin wall thickness is 8", except within the tangential thickening, where the minimum thickness is 12". The link walls are 12" wide.

The bin walls are constructed of 1:2:4 mix concrete, with the exception of the first 22' above the foundation, which is 1:1-1/2:3 mix. The vertical reinforcement is round, deformed rod of intermediate grade, new billet steel. The ten jacking rods are of 1" round, new billet hard steel and are arranged equidistantly around the bin circumference with a single vertical between each rod. The spacing is such that a jacking rod occurs at the point

of tangential contact and a vertical at the link wall contact. The verticals are centered 3-1/2" from the outer surface of the bin wall. The horizontal reinforcing is round, deformed rod of intermediate grade, placed in graduated sizes at 12" fixed course intervals. Only two rod graduations occur--eighty-four courses of 3/4" rod in the first 85' of wall, and twenty-five courses in the upper part of the wall. The horizontals are wired to the outside of the verticals.

The main bins feature conical steel hoppers the full width of the bin. The hoppers are angled at 45°, rather than the usual 36 to 40° angle, and rest within an annular concrete ring girder raised on six free standing radially arranged basement pillars. The ring girder has a twelve-sided interior face and is 2'-6" x 2'. The pillars are 1'-6" x 1'-4" and 10'-6" high. The interspace hoppers are supported by a network of square beams running between and tied to the main bin walls. The base of the beams is 15'-9" above the bin slab. The beams support a central flat plate hopper, the main hoppering being provided by flat slabs of reinforced concrete rising from the beam at 45°. As the bin walls rise from the foundation slab, basement conveyor passages pierce the wall through the transverse tangential thickening. Personnel passages are provided on the diagonal. Light is supplied by two upright windows that pierce every exterior bin wall at basement level. All the basement works are executed in 1:1-1/2:3 mix concrete. The foundation is only a 3' slab of 1:1-1/2:3 mix reinforced concrete, the ground being strong enough to bear the elevator without piling.

The monolithic concrete bin floor is extended 1'-6" beyond the bin line to form overhanging straight-edged eaves with a corbel detail representing an outward extension of the bin floor steel I-beams covered in concrete. As originally constructed, the gallery was a single-story steel and corrugated iron structure. The reinforced concrete workhouse at the southern end of the structure displays exterior pier and panel structural elements. It was slip formed from the foundation simultaneously with the main storage units. The workhouse contains no storage bins, but accommodates three elevating legs and two sets of weighing machinery. Above the bin floor are four stories in ascending order--the distribution floor, the scale floor, the garner floor and the head floor. The structure rises to 200' with a roof line at two levels. The lower part of the structure accommodates a short lofting leg that does not spout to the weighing machinery. The taller part of the structure contains the full lofting legs and the weighing equipment. The garner bins are of concrete, with spouting arranged through nine discharge hoppers in the concrete bottoms.

Construction began at the site in the late winter of 1934, the plans having been worked up and approved during the winter. By March, the site was being cleared for the placing of the foundation slab. Concrete was ready mixed by truck, rather than supplied from an on-site mixing plant. In mid-April, the foundation slab was completed and work commenced on the construction of the form work, a job that was to take five weeks to complete. By May a complete set of form hoops had been delivered from the carpenter's shop, and all the forms were in place with the vertical staves added to the form hoops. Additionally during this period the concreting tower had been completed to the full height of the gallery. The yokes and jacks had been added to the forms, the bin floor I-beams were installed across the forms, and the working platform built across these beams. The working platform spouting arrangements had also been completed.

Following the completion of the form work, about a week of preparation was necessary before slip forming could commence. By late May, the first tier of vertical steel and jacking rods was in place and set in the first lift of concrete. All the props and lintels had been installed to support the areas of the basement bin walling where there were to be apertures. The working platform was equipped with a full set of lights to facilitate continuous pouring and the working platform had been loaded with all bars necessary for subsequent construction. Slip forming could now proceed. By May 31st, twenty feet of wall had been constructed and the concrete finishers platform suspended below the forms, and, after the first week of June, 65' of wall was completed at construction rates of between 7' to 8' per day. In late June, the bins were at full height and the bin floor was under construction. The forms were still in place but the yokes had been removed to facilitate the placing of the bin floor.

By early July, the bin floor was complete and all slip and bin floor forms removed. The workhouse forms had been modified for their upward progress during the construction of the remainder of the workhouse. An additional concreting tower had been added on the working platform of these forms. By mid-July about 15' of the upper workhouse had been slip formed. This complex process included the installation of four sets of floor beams and concrete garner bins and the cutting off of forms at the various roof levels. The workhouse had reached its full height by August 1st.

With the completion of the concreting, work proceeded on the steelwork of the gallery and railroad shed throughout August. At the same time, the plant was being installed in the elevator. The gallery belts and trippers were in place by mid-September, the

bin hoppers later in the month. All the workhouse spouting and elevating equipment appears to have been installed by early October, when the elevator would have been operational. The total construction time was about five months.

In 1937 an extension to the mill considerably augmented the site's milling capacity. A. E. Baxter Engineering designed the seven-story reinforced concrete structure abutting the southernmost part of the old mill. The mill addition incorporates a substantial block of non-cylindrical bins between the second and sixth stories. Another block of rectangular mill storage bins was added immediately to the north of the original mill at an unknown date.

The storage capacity at the site more than doubled with the addition of an annex to the north of the original structure in 1946. Although in alignment with the mainhouse, the two are separated by links from a tile-built conveyor tunnel at basement level; a broad bridge provides a continuous gallery. The elevator was constructed to the design of A. E. Baxter Engineering by the James Stewart Company during the 1946 building season. The elevator features a detached concrete workhouse to the north. The building was slip formed from the foundation slab using the Folwell Sinks patent jacking system.

The elevator has a capacity of 1,314,000 bushels, stored in three parallel rows of thirteen cylindrical bins with an inner diameter of 21'. The bin walls rise 110'-9" from the foundation slab. There are two rows of twelve interspace bins between the main bins. The dimensions and structure of the bins are similar to those of the 1934 elevator. The bins are in tangential contact longitudinally, with non-tangential link wall transverse contacts. Although the dimensions and deployment of the reinforcing is exactly as in the original bins, the bin bottom hoppering is different; the 55° hopper angle in both main and interspace bins facilitates the free flow of feed components. As a result of this increased angle, the hoppers are raised higher within the bin cylinder, and the effective depth of the bin is reduced to 91'-6". The hopper supported on the annular ring girder also resembles that of the 1934 elevator, except that its 2' depth is increased by 2'-4" to accommodate the greater slope of the hopper.

The hopper's twelve-sided external face abuts the interior of the bin wall but is not tied to it. Each face is reinforced with nine straight non-trussed round rods--five 3/4" rods towards the top of the girder, two 1/2" rods in the sides and two 1/2" rods in the base. The horizontals are bound by eight hoops in the beams supported by a pillar, and by six hoops in the others. The

ring girder rests on six radially arranged basement pillars. Like those at the 1934 elevator, these are 1'-6" x 1'-4", but 14'-6" high. The interspace hoppers are supported by a slightly modified beam system. Most notably, the inner rectangular beam network is supported on pilasters running up the outside faces of the cylindrical bins. The bin bottom is likewise inclined 6" thick concrete slabs discharging centrally through a plate steel hopper. The interspace bins are shorter than those in the original elevator, the base of the inner supporting beam being raised 19'-6" above the foundation slab. The inner beams are 12" deep and 18" wide, the outer beams 10" deep and 15" wide. The inner beams are placed so that, in plan, they form a complete rectangular frame to support the base of the concrete hopper slab and the steel hopper bottom. The outer beams do not form a complete rectangle because a section of cylindrical bin wall occurs between each beam. The basement bin walls are pierced in the same positions as the 1934 elevator to provide for the passage of conveyors and personnel. Basement windows are located in the same position. The structure is built on a 3' foundation slab that required no piling for support.

The non-monolithic bin floor is composed of individual concrete bin tops, a design feature that became a Baxter elevator requirement following the 1937 grain dust explosion at the original Eastern States Elevator. The explosion caused extensive damage to the bins close to the workhouse and removed the gallery. The bin caps are reinforced by a diagonal grid of round rods. Above the main bins, they vary in spacing from 12" close to the bin walls to 6" at the center. In the interspace bin caps, they are of 1" rod placed on 6" centers. Supplementary rods are 6" above the tangential links.

The two-story gallery is of structural steel clad in corrugated iron. The roof line is stepped, the lower and upper galleries occupying respectively 2/3" and 1/3" of the width of the building. The upper gallery structure is bridged to the original elevator. At the time of construction of the annex, a second story was added to the gallery of the original elevator so that it might be serviced from the 1946 workhouse.

A separate workhouse, the only known example of the separation of work and storage houses in Buffalo, is provided to the north of the new annex. This placement of the structures was a precaution against explosions that might occur in the particularly dusty atmosphere of the workhouse. Such arrangements appear to have been particularly popular during the first two decades of concrete elevator construction. The 138' high building is of slip formed concrete with pier and panel exterior features. Its operation was connected to the railroad car dumper installed

the same year in a steel shed to the north of the workhouse tower. Three conveyor tunnels link the dumper to the tower.

MATERIALS HANDLING: HISTORY AND DESCRIPTION

The amalgamation of the 1934 and 1945 storage houses at the Eastern States Feed Mill complex resulted in some unusual arrangements for transferring grain between the two sections. All grain received at this elevator arrived via rail, including some lake shipments of frosted Canadian wheat and oats that were landed on the Buffalo waterfront and switched north to the cooperative's complex in the Town of Tonawanda. Principal grain receipts consisted of corn and soybean meal.

In 1934 cars were unloaded in a shed covering three tracks and located between the elevator and the feed mill. Two car pits served Tracks No. 1 and No. 2, with a 60 hp puller to assist in spotting. Receiving belts running through tunnels transferred grain or other feedstocks to the workhouse lofting legs, although the conveyor from Car Pit No. 2 had to negotiate a 90° turn in transit. The workhouse at the south end of the 1934 elevator contained three lofters for receiving and shipping. The legs were driven by individual motors through silent chains and helical gears for double speed reduction. Only the two outer legs elevated to garner-scale sets for instore and outstore weighing.

Each concrete garner in the workhouse featured nine hopper bottoms. The scale hoppers discharged into turnspouts on the distribution floor. These turnspouts could direct instore grain to storage belts or bins or into the adjacent feed mill. A pair of 36" conveyors ran longitudinally over the bin floor. Each belt was equipped with a Prescott tripper for discharging grain at any desired point and also featured roller bearings that helped reduce friction and power consumption. For shipments out of the elevator, three 36" conveyors reclaimed grain from storage and carried it to the boots of the south workhouse lofters. The central leg elevated only up to the bin floor level for redistribution to storage via the conveyors; this leg may have been used for turning over grain in storage to prevent overheating. The two flanking lofters weighed grain for loading out to a car spout serving Track No. 2 or for transfer through spouting and a conveyor bridge into the mill.

Grain received at the 1945 annex was unloaded through a car dumper, the first machinery of its type in the Buffalo area. A company switching locomotive shuttled boxcars into the dumper shed, where they were tipped 15° sideways and 37° endwise. The dumper could empty a car in six minutes and handled an average of

fifty cars per day during the early 1950s. The contents of the cars passed through a receiving hopper to a jack leg with a 72" belt. This short leg elevated to a 2,500-bushel garner-scale set in the north workhouse. Following instore weighing, a second leg re-elevated the grain to the head floor for distribution. The legs used in rail receiving through the north workhouse were driven by 150 hp motors. No outstore grain was handled at the north end of the elevator since shipping functions continued to be concentrated at the south workhouse.

To accommodate instore shipments converging from two directions, Baxter Engineering devised a bi-level gallery, somewhat reminiscent of the arrangements at the Kellogg Elevator. However, at Eastern States, both upper conveyors linking the old and new sections extended the entire length of the storage bins and were designed to function exclusively as distributing belts. A single 48" conveyor ran from the north workhouse across a bridge gallery and into the upper monitor floor (or top gallery). This belt discharged grain via four-pulley tripper into turnspouts that fed the storage bins below. The bottoms of these distribution turnspouts were hinged to pass over the lower belts. The two 36" conveyors on the main monitor floor (or bottom gallery) also ran continuously through both the 1934 and 1945 houses, as did the three shipping belts in the basement. Original and upgraded handling rates for elevating and conveying machinery remain undetermined.

ENDNOTES

1. The following paragraphs use information from original plans, contracts and photo albums of construction inspected courtesy of Henry Baxter.

SOURCES

Engineering Plans, Henry H. Baxter Private Collection, Buffalo, New York.

Buffalo & Erie County Public Library, Local History Scrapbooks, "Industry," VIII:19-20 (Buffalo Courier-Express, 1 March 1953).

APPENDIX

Mainhouse

Foundation: Foundation slab 3', resting directly on clay, reinforced by a diagonal grid of deformed, round rods; beneath main bins of 1" diameter with spacing varying from 12" close to bin walls, to 6" at center; beneath interspaces 1" diameter rods on 6" centers; supplementary rods at 6" intervals below all tangential links

Basement: Enclosed within bin walls, bins rising from basement slab; 6 free-standing radial basement pillars support concrete ring girder pillars 1'6" x 1'-4" x 10'-6"; ring girder has 12-sided interior face, and is 2'-6" x 2 Ring girder not tied into bin wall Basement height 10'-6" from floor slab to ring girder, 2/3 above grade, lit by 2 upright windows per bin

Hoppers: Conical steel to full width of bin supported by ring girder; hopper angle 45° (usual angle 36-40°); interspace hoppers concrete slab supported on concrete beams tied to main bin walls

Bins: Capacity 1,013,000 bushels
Main bins 10 x 3 in parallel rows, cylindrical 21' in diameter; bin height 110'-9" from foundation slab, 96' from top of ring girder
Interspace bins 9 x 2
No outer bins
Tangential contacts longitudinally, Non-tangential contacts transversely by straight link wall; tangential contacts 9'-6" wide
Link walls 2'-6" long
Bin wall thickness 8", at tangential contacts 12"
Vertical reinforcement, round, deformed rod of intermediate grade, new billet steel; jacking rods 1" round, smooth, and of new billet hard steel; 10 jacking rods, with intervening verticals spaced equidistantly around circumference; one jacking rod at

center of every tangential link; verticals centered 3-1/2" from outer surface of the bin wall
Horizontal reinforcing, round deformed rod of intermediate grade in graduated sizes at fixed course intervals; horizontals wired to outside of verticals

Bin Floor: Monolithic concrete on I-beams, overhanging straight eaves with concrete corbel detail

Gallery/ Workhouse: Structural steel clad in corrugated iron
Monolithic concrete, exterior pillar and panel

REFERENCES: The original plans were inspected and the contractor's contemporary photographs viewed courtesy of Henry Baxter.

Annex

Foundation: Foundation slab 3', resting directly on clay reinforced by diagonal grid of round rods; beneath main bins rods of 1" diameter vary in spacing from 12" close to the bin walls to 6" at center; beneath interspaces rods of 1" diameter at 6" centers; supplementary rods placed on 6" centers below tangential links

Basement: Enclosed within bin walls, bins rise from basement slab; 6 free-standing radial basement pillars support concrete ring girder; pillars 1'-6" x 1'-4" x 14'-8"
Ring girder has 12-sided interior face, 4'-4" x 2', not tied into bin wall
Basement height 14'-8", from floor slab to ring girder, 2/3 above grade, lit by 2 upright windows per bin

Hoppers: Conical steel to full width of bin, supported by ring girder
Hopper angle 55° (usual angle 36-40°)
Interspace hoppers slab concrete slab on concrete beams forming rectangle; beams

supported on four pilasters tied to main bin walls

Bins: Capacity 1,314,000 bushels
Main bins 13 x 3, in parallel rows, cylindrical 21' in diameter, Bin height, 110'-9" from foundation slab, 96' from top of ring girder
Interspace bins 12 x 2
No outer bins
Tangential contacts longitudinally, Non-tangential link wall contacts transversely
Tangential contacts are 9'-6" wide link walls are 2'-6" long
Wall thickness 8", at tangential contacts 12"
Vertical reinforcement, round, deformed rod of intermediate grade, new billet steel
Jacking rods are 1" smooth, round of new billet, hard steel; 10 jacking rods, with intervening vertical, spaced equally around circumference One jacking rod at center every tangential link; verticals centered 3-1/2" from surface of outer wall
Horizontal reinforcing, wired to outside of verticals; round deformed rod of intermediate grade, in graduated sizes at fixed course intervals

Bin Floor: Non-monolithic concrete, individual concrete caps to each bin

Upper & Lower Galleries: Structural steel clad in corrugated iron

Workhouse: Separate concrete tower

REFERENCES: The original plans were inspected and contractor's contemporary photographs viewed courtesy of Henry Baxter. The completed house is illustrated in the American Miller & Processor of January, 1948.